COURSE OUTLINE

GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Department of Mathematics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**MAY112**	**SEMESTER**	**Winter**
COURSE TITLE	Fundamental Concepts of Mathematics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	7,5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	*General background*
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://www.math.uoi.gr/GR/studies/undergraduate/courses/may112.html

LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

As a first step, the students get familiar with basic tools of logic, set theory (set operations and properties), relations and functions. Emphasis is given to notions such as collections and families (coverings,) bounds (max, min, sup, inf) as well as to images and pre-images

of sets under functions. Part of the kernel of the course is a detailed axiomatic construction of the real numbers aiming that the students acknowledge this set as result of an axiomatic construction rather than of an empiric approach, yet the value and the significancy of the axiomatic foundation of mathematical structures be apparent. In the section concerning cardinality of sets, besides arithmetic of finite sets, students classify types of infinite sets (finite, numerable, denumerable) and approach in an abstract way the notion of infinity in relation with sets in common use as the sets of naturals, integers, rationals , and reals. A major course learning outcome is that assimilation of the offered knowledge will create a good qualitative background so that students be able to proceed with adequacy to studying other branches of mathematics.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
Others

Analysis and synthesis of data and information
Individual work
Team work
Production of creative and inductive thinking
Production of analytical and synthetic thinking

SYLLABUS

Elements of Logic. Basic set theory, operations and properties, power set, Cartesian products, collections. Relations, properties, equivalence relations, order relations, bounded sets, well ordered sets, principle of infinite reduction, functions, one to one functions, onto functions,

Image and pre image of a set, functions and ordered sets. Families. The set of real numbers: axiomatic approach. The sets of natural numbers, integers. The field of rational numbers. Roots of non negative real numbers. The set if irrational numbers.
The axiom of completeness and equivalent statements. Equivalent sets. Finite sets. Infinite sets. Schroder-Bernstein theorem. Numerable sets. At most numerable sets. Denumerable sets. Cantor' theorem. Axiom of Choice and equivalent statements. A first approach to the necessity of an axiomatic foundation of sets.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of ICT for presentation of essays and assignments.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td><table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Lectures</td><td>65</td></tr><tr><td>Homework</td><td>20</td></tr><tr><td>Individual work</td><td>100</td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>185</td></tr></table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Written examination at the end of the semester including theory and problems-exercises.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Παναγιώτης Χρ. Τσαμάτος, Θεμελιώδεις Έννοιες Μαθηματικής Ανάλυσης, Εκδόσεις Τζιόλα, 2009.

- Α. Τσολομύτης, Σύνολα και Αριθμοί, Leader Books, 2004.

- K. G. Binmore, Logic, Sets and Numbers, Cambridge University Press, 1980.

- W. W. Fairchild and C. I. Tulcea, Sets, W. B. Shaunders Co. Philadelphia, 1970.

- S. Lipschutz, Set Theory and Related Topics, Schaum's Outline Series, New York, 1965.

- D. Van Dalen, H. C. Doets and H. Deswart, Sets: Naïve, Axiomatic and Applied, Pergamon Press, Oxford, 1987.